

PFAS in Organics Potential Implications for Facilities



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Overview

- Importance Organics Management
- What are PFAS
- PFAS in the Organics Stream
- PFAS Regulations Related to Organics
- Concerns and Impact on Organics Management
- Future Outlook

Organics Management



Collection and processing of organic materials for reuse.



Reduces Disposal Needs and Costs



Reduces Leachate Generation



Mitigates Greenhouse Gas Emissions



Improves Soil Health



What is Compost

Compost is the product manufactured through the controlled aerobic, biological decomposition of biodegradable materials.

- **Process to Further Reduce Pathogens (PRFP) *EPA 40 CFR 503 standards***
- **Soil Amendment**
- **Stabilizes Carbon**
 - Contribute plant nutrients
 - Beneficial to support plant growth



What are PFAS



Fluoroalkyl compounds are ubiquitous

- Non-stick cookware
- Automotive gaskets, rings, valves, hoses, EV batteries
- Aerospace, electronics
- Chemical and industrial processes
- Medical
- Outdoor clothing
- Nonwoven membranes for water filtration
- Food contact paper-based grease repellent food packaging/wrapping

Source: American Chemistry Council



Sources of PFAS in Organics Waste

- Feedstocks
 - Food and yard waste
 - Industrial and leachate discharge to WWTP processing biosolids

- Food Contact Materials/Packaging
 - Biodegradable Products Institute (BPI), Effective January 2020
 - Total fluorine maximum 100 ppm
 - Statement of no intentionally added fluorinated chemicals

- PFAS Precursors
 - Oxidation of precursors produces terminal PFAS





Amount of PFAS in MSW Waste by Category

**ΣPFAS Concentration in Organic Waste:
40 ng/g to 135 ng/g**

	U.S. MSW (MM tons/yr)	Organics	Organics (MM tons/yr)
Generation	267.8	29.8%	79.8
Landfilled	139.6	30.4%	42.4
Recycled	128.2	29.2%	37.4



Source: EPA Sustainable Materials Management 2017 Fact Sheet (November 2019)

Source: Kremen, Arie, Tetra Tech



Estimated PFAS Levels in Organic Waste

Item	PFAS Concentration
WWTP Influent	42 – 859 ng/l ⁽³⁾
Landfill Leachate	7,000 – 29,000 ng/l ⁽²⁾
WWTP Effluent	50 – 1,114 ng/l ⁽³⁾
Biosolids	3 – 1,100 ng/g ⁽⁴⁾
Food Packaging	<1 – 485 ng/g ⁽¹⁾
Compost	2.3 – 75 ng/g ⁽¹⁾
Food Waste	<1 – 22 ng/g ⁽¹⁾

1 ng/l = 1,000 ppt
1 ng/g = 1,000 ppt

Sources:

- (1) Emerging Issues in Food Waste Management, Persistent Chemical Contaminants, US EPA Office of Research and Development, August 2021, EPA/600/R-21/115,
- (2) Lang J R et al., National Estimate of Per- and Polyfluoroalkyl Substance (PFAS) Release to US Municipal Landfill Leachate, ES&T, 2017, 51, 2197-2205
- (3) Helmer, Ross et al., Per- and Polyfluorinated Alkyl Substances (PFAS) cycling within Michigan: Contaminated sites, landfills and wastewater treatment plants, Water Research, December 2021.
- (4) Mills, Mark, PFAS Treatment in Biosolids – *State of the Science*, US EPA Office of Research and Development, September 2020



Purdue University Study: PFAS in Municipal Organic Waste Composts

Zero Waste Washington collected 10 compost samples

- 9 commercial composting facilities
- 1 home backyard compost
- 7 of the 9 commercial composting facilities accepted Food Contact Materials (FCM).



Study led to two important legislation

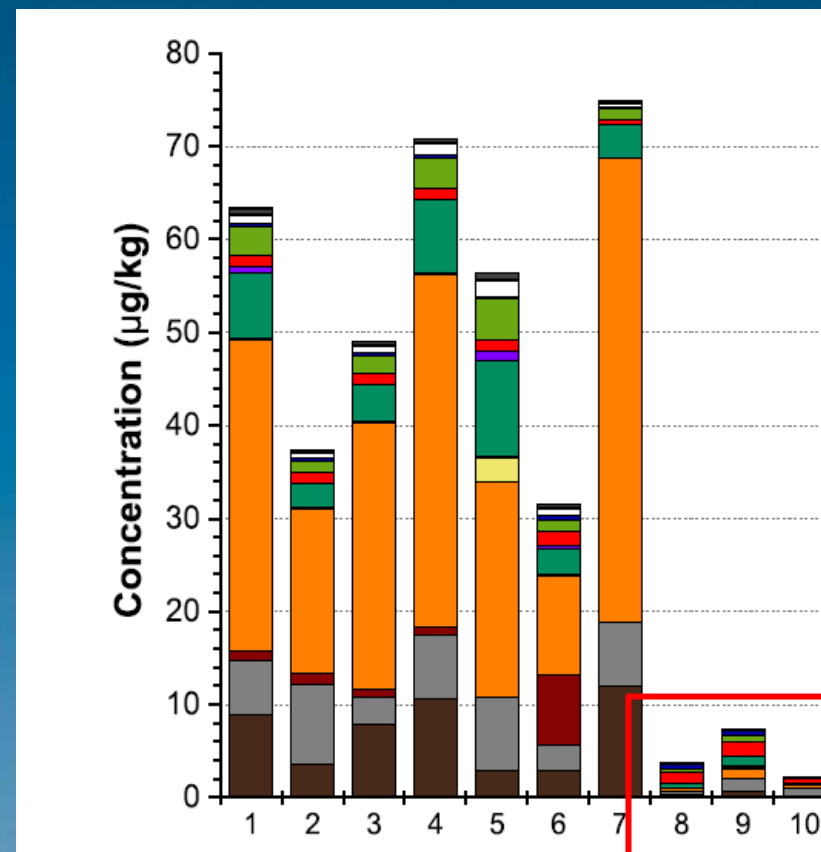
- Healthy Food Packaging Act **HB 2658** to ban PFAS (effective January 2022)
- Compostable Products Labeling **HB 1569** (effective July 1, 2020)
 - Food service products along with certain film products that meet ASTM D6400 standards for industrial compostable must be “readily and easily identifiable” as compostable.

[Source: \(Choi, Lazcano, Yousefi and Lee\) and Zero Waste Washington \(Trim\), 2019](#)



PFAS Concentrations and Prevalence in Municipal Organic Solid Waste Composts

- **Samples 8 & 10 Residential Composting:**
- Yard waste, grass and leaves
- **Sample 9 Home Composting:**
- Food waste, unbleached coffee filters

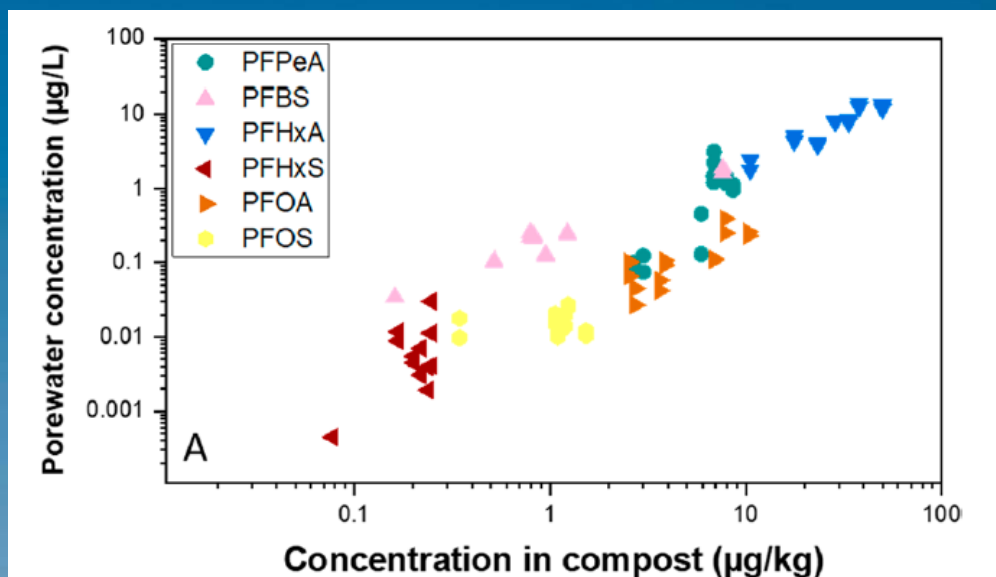


Source: Choi et al. (2019)



PFAS in Composts

- Majority of PFAS in compost are shorter-chain PFAA
- Shorter-chain PFAA have shorter half-lives in humans
 - More mobile in the environment
 - Taken up by plants, accumulating in the food chain
- Concentrations in porewater could exceed NYDEC Drinking Water Source



Source: Choi et al. (2019)

Organic Waste and Biosolids Management Trends



- No significant change in incineration capacity
- Land application of biosolids to be phased out
 - Increased landfill of biosolids
- Landfilling of organics to be reduced through organics diversion

Waste	Annual Tonnage (MM tons/yr)	Diversion Source
Organic Waste	-42.40	from Landfills
Biosolids	+3.94	from Land Application
Net Change	-38.46	

**Potential reduction in landfilling: 38.46 million tons per year.
(Equivalent to 42.7 million CY @ 1,800 lb./CY)**



Land Application of Biosolids

Massachusetts Water Resource Authority (MWRA)

- Reporting is mandatory
- NPDES permits require test influent, effluent and biosolids for PFAS quarterly.
- Required test biosolids for PFAS to continue land applying pellets in Massachusetts.
- MA currently has not developed screening levels or thresholds for PFAS in land applied biosolids.



Source: MWRA Deer Island Facility



Federal Regulations

EPA Roadmap (2021)

- **Effluent Limitations Guidelines for PFAS discharges**
 - Detailed studies to inform rulemaking for suspected industries (anticipated to be completed Fall 2022 for landfills)
 - Leverage NPDES Permitting to reduce PFAS discharges
- **Risk Assessment for PFAS in biosolids to determine if regulating PFAS in biosolids is appropriate (anticipated to be completed Winter 2024).**



States Taking Action on PFAS in Food Packaging

PFAS in Food Packaging		Prohibit Intentionally-added PFAS
NY	Hazardous Packaging Act, Title II of Article 37 of the Environmental Conservation Law	<ul style="list-style-type: none"> by December 31, 2022.
CT	Public Act No. 21-191 Interagency PFAS Taskforce Action Plan (2019)	<ul style="list-style-type: none"> by December 2023. Evaluate PFAS levels in compost; food waste containing compostable food ware items & paper products. EPR for effective waste management of PFAS products.
ME	32 MRS.17SS 3B	<ul style="list-style-type: none"> Prohibits intentionally-added PFAS; requires a safer alternatives. (Prohibits sale of food package containing phthalates as of January 1, 2022)
MD	HB 0275	<ul style="list-style-type: none"> by January 2024.
VT	Act No. 36, Chapter 33A	<ul style="list-style-type: none"> Chemicals of concern by July 1, 2023



MA Regulations

Drinking Water MCL PFAS6 – 20 PPT

- PFOS, PFOA, PFHxS, PFNA, PFHpA, PFDA
- Cleanup standards of groundwater and soil

Funding (MassDEP and DPH) to conduct PFAS testing all water sources drinking water, ground water, surface water

- Disposal of materials containing PFAS leads to a cyclical program of releasing PFAS into solid waste, atmospheric and aqueous pathways, which leads to human exposure to PFAS, as well as wildlife and the natural world.
- Landfilling these materials can contribute to leachate, sludge and wastewater and biosolids.

Evolving Concerns for Organics Management



- **Source Contamination**
 - Relatively low for organic waste
- **Materials Management**
 - Use of product for land applications
 - Restricted use or even disposal
 - Disposal of waste materials
 - Landfills hesitant to accept PFAS contaminated materials
 - Disposal of leachate
 - WWTPs placing restrictions
- **Regulations for Organic Materials**
 - Sampling and monitoring products (i.e. biosolids, and finished compost)
 - Requirements on use for land application





Conclusions and Recommendations

- Science is still emerging.
- Look upstream to remove PFAS out of consumer products.
- Consider to ban products containing fluorinated chemicals (i.e., Washington State).
- Composting plays a critical role
Sustainable Food Systems and Zero Waste/Reduction goals.
- Develop end-markets for compost use.

Thank You



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